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10/804,992	03/19/2004	Thorsten Heinz	SCHO0174	8937

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EXAMINER	
YIP, JACK	

ART UNIT	PAPER NUMBER
3715	

NOTIFICATION DATE	DELIVERY MODE
08/06/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	**Application No.** 10/804,992	**Applicant(s)** HEINZ ET AL.	
	Examiner JACK YIP	**Art Unit** 3715	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _19 February 2010_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-21,23 and 24_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-21,23 and 24_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1 - 3, 5 - 8, 21, 23 - 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Ray Meddis ("Virtual pitch and phase sensitivity of a computer model of the auditory periphery. I: Pitch identification" - 1/24/1991) denoted as **Meddis'91**.

<u>Re claims 1, 21:</u>

[Claim 1] Meddis'85 discloses a hardware apparatus for analyzing a sound signal (Meddis'91, pg 2867, "A. Introduction"), comprising: an ear model for deriving, for a number of inner hair cells, an estimate for a time-varying concentration of a transmitter substance inside a cleft between an inner hair cell and an associated auditory nerve from the sound signal (Meddis'91, pg 2867 - 2868, "B Stages 1 and 2: Outer- and middle-ear effects"), so that an estimated inner hair cell cleft contents map over frequency and over time is obtained (Meddis'91, pg 2868, fig 2(b)) wherein the inner hair cells comprising lower order inner hair cells indicating lower frequencies and higher order inner hair cells indicating higher frequencies (Meddis'91, pg 2868, fig 3(b), "Channel center frequency", "Time", "Hair cell response"); and a pitch analyzer for analyzing the cleft contents map to obtain a pitch line over time, the pitch line indicating a pitch of the sound signal for respective time instants, wherein the pitch line varies in time over higher frequencies and lower frequencies as determined by the pitch analyzer (Meddis'91, from pgs 2871, "PITCH STUDIES", i.e. pg 2871, "Figure 3(c) illustrates the pitch extraction ability of the model for a pulse train..." i.e. fig 6, fig 7).

[Claim 21] A method of analyzing a sound signal, comprising: deriving, for a number of inner hair cells, an estimate for a time-varying concentration of a transmitter substance inside a cleft between an inner hair

cell and an associated auditory nerve from the sound signal, so that an estimated inner hair cell cleft contents map over frequency and over time is obtained, wherein the inner hair cells comprising lower order inner hair cells indicating lower frequencies and higher order inner hair cells indicating higher frequencies; and analyzing the cleft contents map to obtain a pitch line over time, a pitch line indicating a pitch of the sound signal for respective time instants, wherein the pitch line varies in time over higher frequencies and lower frequencies as determined by analyzing the cleft contents map, wherein the method of analyzing is implemented in hardware in the form of a state machine or in software, which is executed by a programmable processor for performing the method of analyzing (Meddis'91, pg 2866, "a computer model"; See claim 1 above).

Re claim 2:

The hardware apparatus in accordance with claim 1, further comprising a rhythm analyzer for analyzing estimates for selected inner hair cells, the inner hair cells being selected in accordance with the pitch line, so that segmentation instants are obtained, wherein a segmentation instant indicates an end of a preceding note or a start of a succeeding note (Meddis'91, pg 2874, "D. Musical chords", "E. Repetition pitch").

Re claim 3:

The hardware apparatus in accordance with claim 1, in which the ear model comprises: a mechanical ear model for modeling an auditory mechanical sound processing up to the inner ear (cochlea) to obtain estimates for representations of mechanical vibrations of the basilar membrane and lymphatic fluids (Meddis'91, pg 2869, "D. Stage 4: Mechanical to neural transduction"); and an inner hair cell model for transforming the estimates for representations of mechanical vibrations into the estimates for the transmitter concentrations at the inner hair cells (Meddis'91, pg 2868, fig 3(b)).

Re claim 5:

The hardware apparatus in accordance with claim 1, wherein the pitch analyzer further comprises a vibration period detector, the vibration period detector being operative for calculating a summary auto correlation function for each time period of a number of adjacent time periods using the estimates for the transmitter concentrations of the number of inner hair cells (Meddis'91, fig 3(c), "Autocorrelagrams"), and wherein the vibration period detector is further operative, for each inner hair cell, to calculate at least one period between two adjacent maxima in one estimate, and to enter a result into a summary auto correlation function histogram (Meddis'91, pg 2869, "Amounts of transmitter held in the free transmitter pool are expressed here as fractions of an arbitrary maximum value m, which has been set to unity in this implementation").

<u>Re claim 6:</u>

The hardware apparatus in accordance with claim 5, in which the pitch analyzer is operative to retrieve a maximum value from each histogram of the time sequence of histograms, the maximum value representing a pitch in the time period so that pitch line points are obtained (Meddis'91, pg 2869, "Amounts of transmitter held in the free transmitter pool are expressed here as fractions of an arbitrary **maximum value *m***…" pg 2878, fig 18).

<u>Re claim 7:</u>

[Claim 7] The hardware apparatus in accordance with claim 6, in which the pitch analyzer is further operative to build pitch line subtrajectories by combining pitch line points being close in time with respect to a time threshold and being close in frequency with respect to a frequency threshold (Meddis'91, from pgs 2871, "PITCH STUDIES", i.e. pg 2871, "Figure 3(c) illustrates the pitch extraction ability of the model for a pulse train..." i.e. fig 6, fig 7).

<u>Re claim 8:</u>

[Claim 8] The hardware apparatus in accordance with claim 7, in which the pitch line analyzer is further operative to fuse pitch line subtrajectories with a minimum length and to discard any subtrajectories not

fulfilling a criterion related to a minimum length and amplitude (Meddis'91, from pgs 2871, "PITCH STUDIES", i.e. pg 2871, "Figure 3(c) illustrates the pitch extraction ability of the model for a pulse train..." i.e. fig 6, fig 7).

<u>Re claims 23 - 24:</u>

[Claim 23] The hardware apparatus of claim 1, wherein the pitch line over time is used for one or more members of the group comprising: performing a transcription, performing a sound source recognition, performing a music recognition, performing a query by humming process, displaying the pitch line over time (Meddis'91, from pgs 2871, "PITCH STUDIES", i.e. pg 2871, "Figure 3(c) illustrates the pitch extraction ability of the model for a pulse train..." i.e. fig 6, fig 7), extracting auditory streams, identifying performing singers, and performing an instrument recognition.

[Claim 24] The method of claim 21, wherein the pitch line over time is used for one or more members-of the group comprising: performing a transcription, performing a sound source recognition, performing a music recognition, performing a query by humming process, displaying the pitch line over time (Meddis'91, from pgs 2871, "PITCH STUDIES", i.e. pg 2871, "Figure 3(c) illustrates the pitch extraction ability of the model for a pulse train..." i.e. fig 6, fig 7), extracting auditory streams, identifying performing singers, and performing an instrument recognition.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ray Meddis ("Virtual pitch and phase sensitivity of a computer model of the auditory periphery. I: Pitch identification" - 1/24/1991) denoted as **Meddis'91** in view of Ray Meddis ("Simulation of mechanical to neural transduction in the auditory receptor" - 10/16/1985) denoted as **Meddis'85**.

Re claim 4:

Meddis'91 does not discloses the hardware apparatus in accordance with claim 1, in which the ear model is operative to calculate a transmitter concentration for at least 100 inner hair cells, wherein each inner hair cell is associated with a specified area of a modeled basilar membrane, and wherein each inner hair cell has associated therewith a different specified area of the modeled basilar membrane. Meddis'85 teaches Meddis'91's deficiency (Meddis'85, pg 708; fig 11). Meddis'85 does not disclose expressly that the ear model is operative to calculate a transmitter concentration for at least 100 inner hair cells. At the time the invention was made, it would have been an obvious matter of design choice to a person of ordinary skill in the art to calculate a transmitter concentration for at least 100 inner hair cells because applicant has not disclosed that 100 inner hair cells provides an advantage, is used for a particular purpose, or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected to calculate a transmitter concentration for adequate number of inner hair cells to accurately represent the modeled basilar membrane.

5. Claims 9 - 11, 17 - 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ray Meddis ("Virtual pitch and phase sensitivity of a computer model of the auditory periphery. I: Pitch identification" - 1/24/1991) denoted as **Meddis'91** in view of Clarisse et al. ("An Auditory Model Based Transcriber of Singing Sequences" - 2002) denoted as **Clarisse**.

Re claims 9 - 11, 17 - 20:

Meddis'91 does not disclose a rhythm analyzer. Clarisse discloses a new system for the automatic transcription of singing sequences into a sequence of pitch and duration pairs is presented. [Claim 9] Clarisse discloses the hardware apparatus in accordance with claim 2, in which the rhythm analyzer comprises a searcher for searching a dominant estimate for a transmitter concentration in a specified time

period and comprising a dominant frequency determined by the pitch line so that, for adjacent time periods, corresponding dominant estimates for different inner hair cells are obtained, wherein the searcher is operative to acknowledge a dominant estimate, when the dominant estimate is above a threshold (Clarisse, pg 6, "5.2 The segmentation algorithm, 1 While searching for a maximum”). [Claim 10] Clarisse further discloses the threshold is an amplitude of an estimate comprising the second largest amplitude so that the dominant estimate comprises the largest amplitude in a specified time period (Clarisse, pg 6, "5.2 The segmentation algorithm, 1 While searching for a maximum”; fig 4). [Claim 11] Clarisse further discloses the rhythm analyzer is operative to build an onset map by calculating an onset value for a dominant estimate for a specified time period, the onset map including a sequence of onset values (Clarisse, pgs 6 - 7, “The onset and offset of a note segment…”). [Claim 17] Clarisse discloses the hardware apparatus in accordance with claim 1, further comprising a timbre recognition module, the timbre recognition module being operative for: constructing a feature vector (Clarisse, pg 6); feeding the feature vector into a pattern recognition device (Clarisse, pg 4); and obtaining a result indicating a probability that at least a portion of the sound signal has been produced by a sound source from a number of different specified sound sources (Clarisse, pg 7). [Claim 18] Clarisse discloses the hardware apparatus in accordance with claim 17, in which the pattern recognition device is a neural network (Clarisse, pg 5, “neural fiber”). [Claim 19] Clarisse disclose the hardware apparatus in accordance with claim 17, in which the feature vector comprises one or more selected members from a feature group including onset time of a fundamental vibration or a higher order partial vibration, a frequency of a fundamental vibration or a higher order partial vibration, an amplitude of a fundamental vibration or a higher order partial vibration, a number of an estimate for the transmitter concentration using the highest peak for the fundamental vibration or a higher order partial vibration, or a number of an estimate for the transmitter concentration being in resonance for a fundamental vibration or a higher order partial vibration (Clarisse, pg 2, “fundamental frequencies”). [Claim 20] Clarisse disclose the hardware apparatus in accordance with claim 2, further comprising a transcription module, the transcription module being operative for using the pitch line segmented at segmentation instants to output a note description or a MIDI description (Clarisse, pg 2, “3.2 Making the reference transcriptions”; pg 7).

Therefore, in view of Clarisse, it would have been obvious to one of ordinary skill in the art, at the time of invention, to modify the apparatus/method described in Meddis'91, by providing the rhythm analyzer as taught by Clarisse, since Clarisse (Clarisse, pg 1, ABSTRACT, "… a new system for the automatic transcription of singing sequences into a sequence of pitch and duration pairs is presented. Although such a system may have a wider range of applications, it was mainly developed to become the acoustic module of a query-by-humming (QBH) system for retrieving pieces of music from a digitized musical library. The first part of the paper is devoted to the systematic evaluation of a variety of state-of-the art transcription systems. The main result of this evaluation is that there is clearly a need for more accurate systems. Especially the segmentation was experienced as being too error prone (~20 % segmentation errors)… a new auditory model based transcription system is proposed and evaluated. The results of that evaluation are very promising. Segmentation errors vary between 0 and 7 %, dependent on the amount of lyrics that is used by the singer. The paper ends with the description of an experimental study that was issued to demonstrate that the accuracy of the newly proposed transcription system is not very sensitive to the choice of the free parameters, at least as long as they remain in the vicinity of the values one could forecast on the basis of their meaning."

6. Claims 12 - 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ray Meddis ("Virtual pitch and phase sensitivity of a computer model of the auditory periphery. I: Pitch identification" - 1/24/1991) denoted as **Meddis'91** in view of Clarisse et al. (An Auditory Model Based Transcriber of Singing Sequences" - 2002) denoted as **Clarisse** and Sumner et al. ("Adaption in a revised inner-hair cell model" - 8/30/2002) denoted as **Sumner**.

<u>Re claims 12 - 16:</u>

Meddis'91 does not disclose rhythm analyzer is operative to calculate an onset value such that an onset value is higher, when an onset comprises a stronger onset rise, compared to another onset comprising a weaker onset rise. Sumner teaches Meddis'91 deficiency. Sumner discloses (Sumner, pg 893) a revised computational model of the inner-hair cell (IHC) and auditory-nerve (AN) complex. [Claim 12] Sumner

teaches the hardware apparatus in accordance with claim 11, in which the rhythm analyzer is operative to calculate an onset value such that an onset value is higher, when an onset comprises a stronger onset rise, compared to another onset comprising a weaker onset rise (Sumner, fig 6; pg 899 - 900; pg 895, “TABLE I”; pg 896, figs 3 - 4). [Claim 13] Sumner further teaches the hardware apparatus in accordance with claim 11, in which the rhythm analyzer is operative to calculate an onset value such that the onset value is higher, when a starting level before an onset is lower compared to another onset comprising a higher starting level (Sumner, fig 6; pg 899 - 900; pg 895, “TABLE I”; pg 896, figs 3 - 4). [Claim 14] Sumner further discloses the hardware apparatus in accordance with claim 2, in which the rhythm analyzer is operative to use an estimate for an inner hair cell representing a fundamental vibration or using an estimate for an inner hair cell representing at least one higher partial vibration (Sumner, from pg 893, “II THE MODEL”; from pg 894, "III. MODELING AN ADAPTION CHARACTERISTICS”). [Claim 15] Sumner further discloses the hardware apparatus in accordance with claim 2, in which the rhythm analyzer is operative to build an onset histogram by combining onset values of estimates for an inner hair cell representing the fundamental vibration, and onset Values of an estimate for an inner hair cell representing at least one higher partial vibration, which comprises a time distance smaller than a specified time distance threshold (Sumner, from pg 893, “II THE MODEL”; from pg 894, "III. MODELING AN ADAPTION CHARACTERISTICS”). [Claim 16] Sumner discloses the hardware apparatus in accordance with claim 11, in which the rhythm analyzer is operative to extract maxima from the onset histogram, wherein a time value associated with a maximum indicates a segmentation instant (Sumner, fig 6; pg 899 - 900; pg 895, “TABLE I”; pg 896, figs 3 - 4).

Therefore, in view of Sumner, it would have been obvious to one of ordinary skill in the art, at the time of invention, to modify the apparatus/method described in Meddis, by providing the onset value as taught by Sumner, since Sumner states (Sumner, pg 893) “One key improvement is that the model reproduces the rate-intensity functions of low- (LSR), medium- (MSR), and high-spontaneous rate (HSR) fibers in the guinea-pig. Here we describe the adaptation characteristics of the model, and how they vary with model fiber type. Adaptation of the revised model for a HSR fiber is in line with an earlier version of the model

[Meddis and Hewitt, J. Acoust. Soc. Am. 90, 904–917 (1991)]. In guinea-pig, poststimulus time histograms (PSTH) have been found to show less adaptation in LSR fibers. Evidence from chinchilla suggests that this is due to chronic adaptation resulting from short interstimulus intervals, and that fully recovered LSR fibers actually show more adaptation. However, the model is able to account for both variations of PSTH shape when fully recovered from adaptation. Interstimulus interval can also affect recovery in the model. The model is further tested against data previously used to evaluate models of AN adaptation. The tests are (i) recovery from adaptation of spontaneous rate and (ii) the recovery of response to acoustic stimuli ("forward masking''), (iii) the response to stimulus increments and (iv) decrements, and (v) the conservation of transient components. A HSR model fiber performs similarly to the earlier version of the model. However, there is considerable variation in response to increments and decrements between different model fibers."

Response to Arguments

7. Applicant's arguments with respect to claims 1 - 21, 23 - 24 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JACK YIP whose telephone number is (571)270-5048. The examiner can normally be reached on Monday - Friday 9:30am - 5:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Xuan Thai can be reached on (571)272-7147. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J. Y./
Examiner, Art Unit 3715

/XUAN M. THAI/
Supervisory Patent Examiner, Art Unit 3715